

Name: _____

Biology

Question and Answer Book

Unit 3 Trial Exam 1 (2025)

- Reading time is **10 minutes**
- Writing time is **90 minutes**

Materials supplied

- Question and Answer Book of 16 pages

Instructions

- Follow the instructions outlined at the beginning of Section A and Section B.

Students are not permitted to bring mobile phones and/or any unauthorised electronic devices into the examination room.

Contents	pages
Section A (30 questions, 30 marks)	2-7
Section B (7 questions, 60 marks)	8-15



Section A - Multiple-choice questions

Instructions

- Answer all questions in pencil on the Multiple-Choice Answer Sheet.
 - Choose the response that is correct or that best answers the question
 - A correct answer scores 1; an incorrect answer scores 0.
 - Marks will not be deducted for incorrect answers.
 - No marks will be given if more than one answer is completed for any question.
 - Unless otherwise indicated, the diagrams in this book are not drawn to scale.
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Question 1

What is the primary function of nucleic acids in cells?

- A. Energy storage
- B. Structural support
- C. Information storage
- D. Enzyme catalysis

Question 2

During translation, which of the following are not present.

- A. Water
- B. Peptide bonds
- C. Amino acids
- D. Introns

Question 3

During which process is mRNA synthesized from the DNA template?

- A. Translation
- B. Replication
- C. Transcription
- D. RNA splicing

Question 4

What is the role of tRNA in gene expression?

- A. Carrying amino acids to the ribosome
- B. Acting as a template for DNA replication
- C. Serving as a structural component of ribosomes
- D. Initiating transcription

Question 5

In eukaryotic cells, what occurs during RNA processing?

- A. Translation of mRNA into a protein
- B. Removal of exons from mRNA
- C. Addition of a 5' cap and poly-A tail to mRNA
- D. DNA replication



Question 6

Which of the following is a characteristic of the genetic code?

- A. Ambiguous
- B. Non-degenerate
- C. Universal
- D. Consists of two nucleotide codons

Question 7

What is the function of the antiterminator loop in *E. Coli*?

- A. Synthesis of tryptophan
- B. Breakdown of tryptophan
- C. Regulation of gene expression
- D. Replication of DNA

Question 8

The trp operon produces:

- A. Microtubules
- B. Structural proteins
- C. Repressor proteins
- D. Regulatory proteins

Question 9

In the production of human insulin, the use of a plasmid is beneficial because:

- A. It can make insulin
- B. It is easily locatable in humans
- C. It contains antibiotic resistance
- D. It has the same structure as a human chromosome

Question 10

The CRISPR-Cas9 complex in bacteria is effective because:

- A. Cas9 enzyme, alone, can easily cut bacteriophage DNA
- B. The CRISPR sequence contains repeats
- C. Bacteriophage DNA does not contain a PAM sequence
- D. Bacterial DNA does not contain a PAM sequence

Use the following information for Questions 11 - 13

A group of researchers is conducting an experiment to measure the impact of temperature on the rate of cellular respiration in yeast. They perform multiple trials using the same batch of yeast and the same equipment, but they notice that their ethanol measurements vary slightly each time, despite keeping all conditions constant.

Question 11

The variation in the researchers' measurements is most likely due to:

- A. Systematic errors
- B. Random errors
- C. Personal errors
- D. Measurement precision

Question 12

The researcher's test is valid, because _____.

- A. The experiment can be repeated multiple times with the same result
- B. The researchers only change the amount of yeast
- C. The experiment measures what it is supposed to measure
- D. The results are close to the true value

Question 13

In the experiment, the researchers measure the rate of cellular respiration by measuring _____, which is the _____ variable.

- A. Amount of yeast, dependent
- B. Temperature, independent
- C. Different batches of yeast, independent
- D. Amount of ethanol, dependent

Question 14

Anaerobic fermentation of biomass for biofuel production is particularly useful because:

- A. It produces large amounts of oxygen
- B. It requires no input of water
- C. It is from renewable sources
- D. It increases the rate of photosynthesis

Question 15

The light-dependent stage of photosynthesis occurs in the:

- A. Stroma
- B. Thylakoid membranes
- C. Cytoplasm
- D. Cristae

Question 16

Which factor would least affect the rate of photosynthesis in a C₄ plant?

- A. Light availability
- B. Water availability
- C. Oxygen concentration
- D. Temperature

Question 17

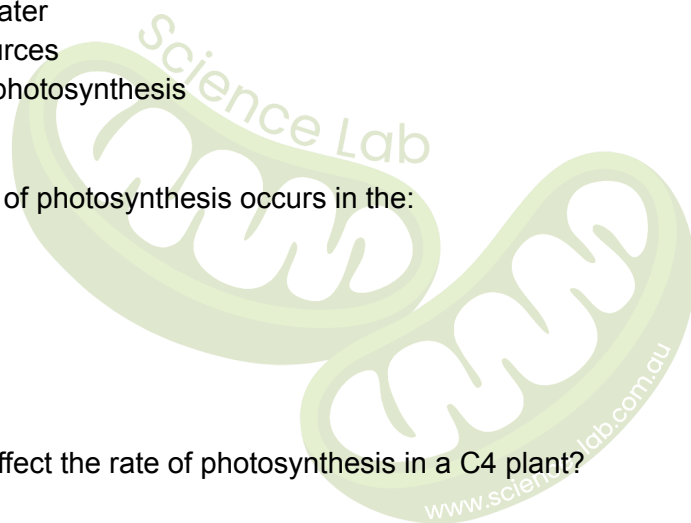
During glycolysis, the main input molecule is:

- A. Oxygen
- B. Glucose
- C. Pyruvate
- D. NADH

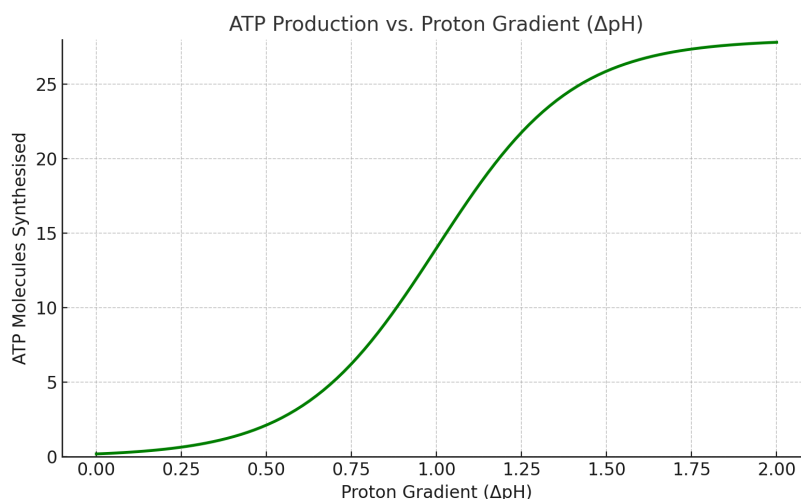
Question 18

The role of coenzyme NAD⁺ in cellular respiration is to:

- A. Transport oxygen
- B. Provide energy directly
- C. Accept electrons during glycolysis and the Krebs cycle
- D. Facilitate ATP synthesis



Use the information, below, to answer Question 19-20



Question 19

In which stage of aerobic cellular respiration would the graph above be most related to

- A. Glycolysis
- B. Lactic acid fermentation
- C. Electron transport chain
- D. Pyruvate processing

Question 20

The size of the change in pH is greatest when the most ATP is produced is because

- A. ATP is basic
- B. The formation of NAD^+ creates a more acidic environment
- C. ATP synthase disrupts the ability to remove basic ions
- D. There is more oxygen available

Question 21

Which enzyme is primarily responsible for fixing carbon dioxide in the Calvin cycle?

- A. ATP synthase
- B. RuBisCO
- C. PEP carboxylase
- D. NADP+ reductase

Question 22

Competitive inhibitors of enzymes function by:

- A. Binding to the active site of the enzyme
- B. Changing the enzyme's shape
- C. Reducing the enzyme's temperature
- D. Increasing substrate concentration

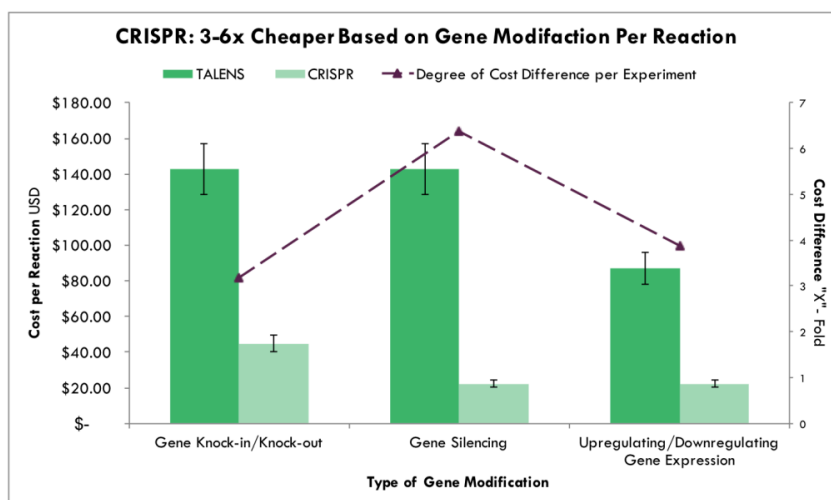
Question 23

C4 and CAM plants are adapted to their environments by:

- A. Utilising Rubisco more efficiently at low temperatures
- B. Reducing water loss while maximising carbon fixation
- C. Increasing oxygen production
- D. Lowering their rate of photosynthesis

Use the information to answer Question 24-27

CRISPR is a widely accepted gene editing tool. However, other technologies that allow for gene modification exist, such as Transcription Activator-Like Nuclease (TALENs) and Zinc Finger Nucleases (ZFN).



Source: ARK Investment Management LLC | ark-invest.com

Source: ARK Invest, CRISPR vs. TALENs: What's the difference?, ARK Investment Management LLC, 2022, viewed 7 July 2025, <https://www.ark-invest.com/articles/analyst-research/crispr-vs-talens>

Recent news articles discuss the use of CRISPR-Cas9 technology to modify the genetic makeup of C3 crops.

Question 24

CRISPR-Cas9 technology could potentially be used in agriculture to:

- A. Alter the light-dependent reactions of photosynthesis
- B. Increase the efficiency of Rubisco in C3 plants
- C. Enhance the production of lactic acid in fermentation
- D. Convert CAM plants into C3 plants

Question 25

Critics may argue that the widespread use of CRISPR-modified crops may lead to:

- A. Increased biodiversity due to more efficient photosynthesis
- B. A reduction in the rate of photosynthesis across all plants
- C. Unintended ecological consequences and ethical dilemmas
- D. Improved oxygen production benefiting all ecosystems

Question 26

In which type of gene mutation, would CRISPR be most cost effective compared to TALENS?

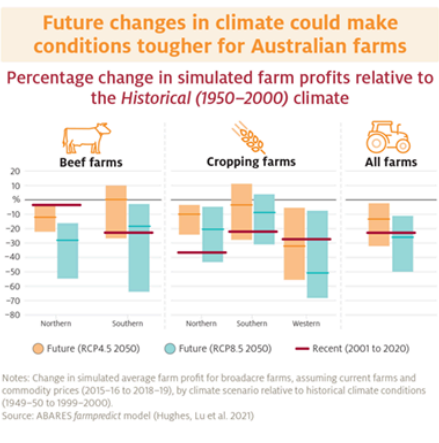
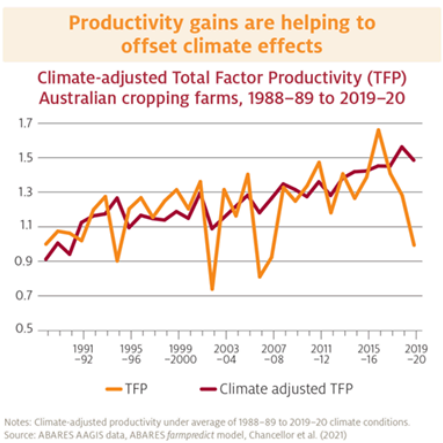
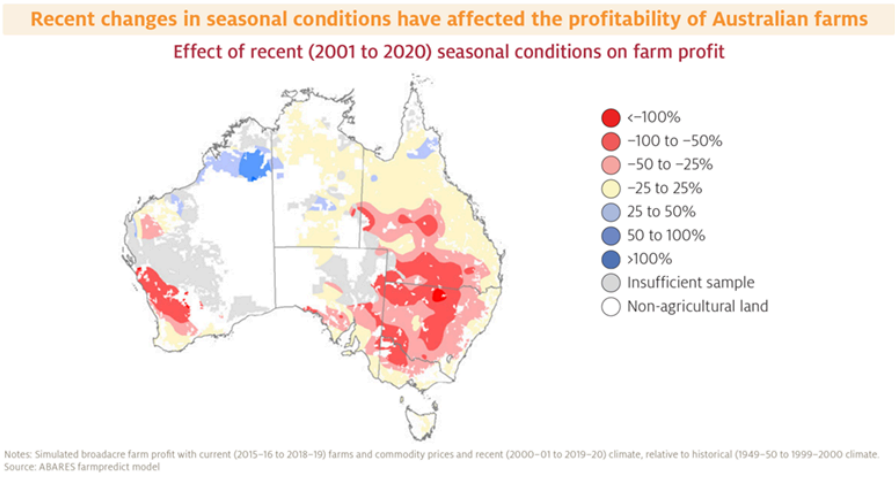
- A. Gene Knock-in/ Knock-out
- B. Gene Silencing
- C. Upregulating/Downregulating Gene Expression
- D. All of the above

Question 27

Knocking-in a gene may be more expensive than gene silencing because:

- A. It requires the identification and production of a target gene sequence
- B. It does not require endonucleases
- C. It is designed to induce mutations in the template strand
- D. It is the original function of Cas9 in bacteria

Use the information to answer Question 28-30



Source: Department of Agriculture, Fisheries and Forestry (DAFF), Climate change impacts on Australian farmers [infographic], Australian Government, viewed 7 July 2025, <https://www.agriculture.gov.au/sites/default/files/images/climate-change-impacts-aus-farmers-infographic-1-01.png>

Question 28

Which areas of Australia saw the greatest profit from recent seasonal conditions:

- A. Coastal areas of Southern Western Australia
- B. Northern areas of Western Australia
- C. Coastal regions of Southern Queensland
- D. Tasmania

Question 29

Many of the crops grown in Australia are C3 plants.

What future changes in climate could the DAFF be expecting that would make conditions tougher for Australian farms.

- A. Lower atmospheric O₂ concentration
- B. More water availability for crops
- C. Higher atmospheric CO₂ concentration
- D. Higher average temperatures above 25°

Question 30

Some of the results measuring the profitability of Australian farms may be uncertain because

- A. It is not close to the true value
- B. Readings are all close together
- C. Some of the data sets are incomplete
- D. The experiment did not measure its aim



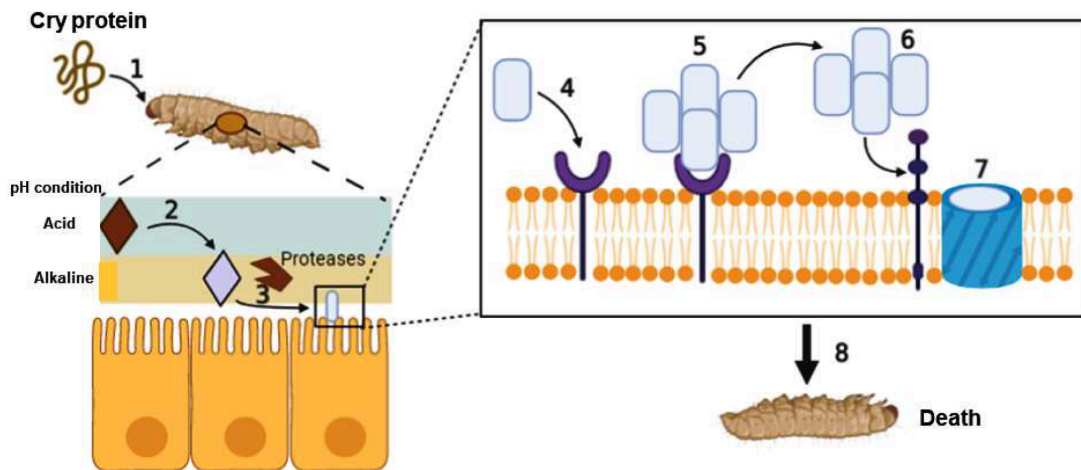
Section B

Instructions

- Answer all questions in the space provided.
- Write your responses in English.
- Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1 (17 marks)

Bt corn is engineered to express a gene from the bacterium *Bacillus thuringiensis* (Bt). This gene codes for Cry proteins, which are toxic to the larvae of the European corn borer (*Ostrinia nubilalis*) and corn rootworm (*Diabrotica spp.*). When these insects ingest the Cry proteins, they bind to receptors in the insect's gut, causing cell lysis and death.



Source: Palma, L, Muñoz, D, Berry, C, Murillo, J & Caballero, P 2021, 'Importance of Cry proteins in biotechnology: initially a bioinsecticide, now a vaccine adjuvant', *Life*, vol. 11, no. 10, article 999, viewed 8 July 2025, <https://www.mdpi.com/2075-1729/11/10/999>

a. Is Bt corn a transgenic organism? Justify your response.

2 marks

b. Outline the process scientists would use to produce *Ostrinia nubilalis* resistant corn.

4 marks

The bacteria, *Bacillus thuringiensis* (Bt), is able to regulate the production of tryptophan by the same mechanism as many other prokaryotes, such as *Escherichia coli*.

c. Describe the importance of tryptophan regulation in prokaryotes and outline how the concentration of free floating tryptophan influences this process. 3 marks

During corn processing, many farms remove the husk (the dry outer covering of some fruits or vegetables) and discard it as a waste product.

d. Identify if corn husk is a primary or secondary generation of biofuel. Outline a method farmers could use to turn this waste into a form of additional income or energy for their farm. 5 marks

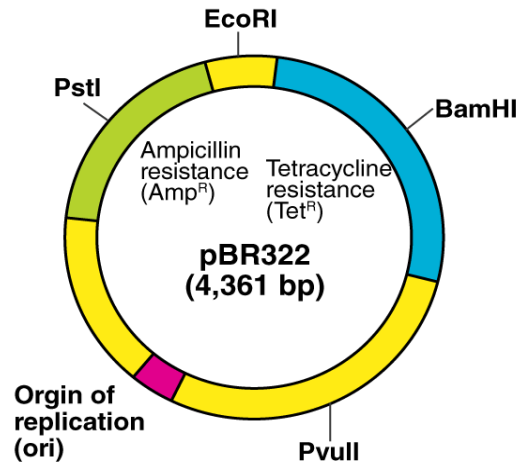


South Queensland and Tasmania experience distinct weather conditions, with South Queensland having a warmer, humid climate, and Tasmania experiencing cooler, wetter conditions. Given these differences, South Queensland is a large producer of Australian grown corn whereas Tasmania largely grows wheat.

e. Considering adaptations of some plant types to maximise photosynthetic efficiency, explain why crops like wheat are better suited to Tasmania than Queensland. 3 marks

Question 2 (5 marks)

Traditionally, Rennin, an enzyme used to coagulate milk in cheese production, was extracted from the fourth stomach of young calves or other young ruminant mammals, such as lambs or camels. However, scientists now use bacterial transformation to produce this protein. The plasmid used in this bacterial transformation is shown below.



Source: BYJU'S, Diagram of PBR322 plasmid, 2020, viewed 7 July 2025, <https://cdn1.byjus.com/wp-content/uploads/2020/05/PBR-322-plasmid-1.png>

a. Outline what would occur to a bacteria that did not take up the pBR322 plasmid. 1 mark

b. Insertion of the Rennin gene disrupts the gene coding for tetracycline resistance. Explain how transformed bacteria would be identified using the two antibiotic resistance genes found in the pBR322 plasmid. 4 marks

Question 3 (7 marks)

Australia is made up of many different biomes, outlined by varying environmental factors. It is therefore home to a number of endemic plant species that have adapted overtime to better suit their ecological niche. A list of native Australian flora is listed below, along with their habitat, average water loss and daytime carbon dioxide uptake.

Plant Species	Type of Photosynthesis	Habitat Type	Average Stomatal Water Loss	Daytime CO ₂ Uptake
<i>Themeda triandra</i>	C3	Coastal temperate grassland	High	High
<i>Sporobolus virginicus</i>	C4	Semi-arid inland grassland	Medium	High
<i>Portulaca australis</i>	CAM	Arid zone rocky outcrop	Low	Low

a. Identify which species has the highest water use efficiency and explain how its photosynthetic adaptation contributes to this ability. 3 marks

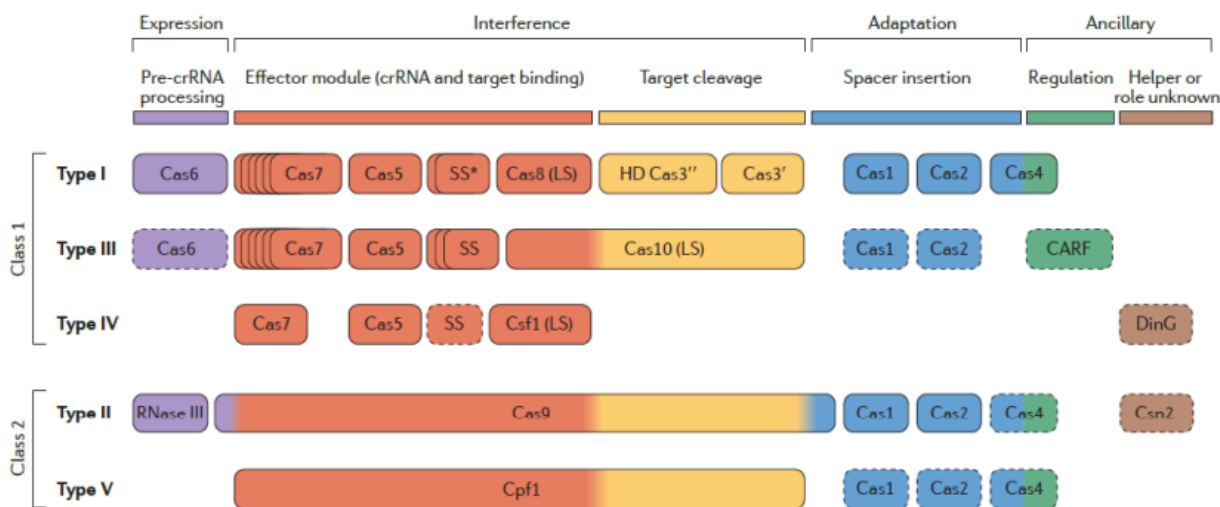
b. Compare the role of RuBisCO in these three plant types. 1 mark

c. Define reproducibility and outline how the reproducibility could be improved. 2 marks

d. Identify what scientific methodology was used to collect this data. 1 mark

Question 4 (7 marks)

There are many different Cas proteins. Below are the classification of a number of these Cas proteins, some of which are involved in the development of the CRISPR sequence in bacteria.



Source: Sassone-Corsi, M & Raffatellu, M 2015, 'No vacancy: how beneficial microbes cooperate with immunity to provide colonization resistance to pathogens', Nature Reviews Microbiology, vol. 13, no. 12, pp. 791–801, viewed 7 July 2025, <https://doi.org/10.1038/nrmicro3569>

a. With reference to the information above, justify which of the Cas proteins has the broadest function. 2 marks

The CRISPR sequence was discovered in 1987. However, it was not until 2003 that it began being referred to as a “primitive adaptive immune system”.

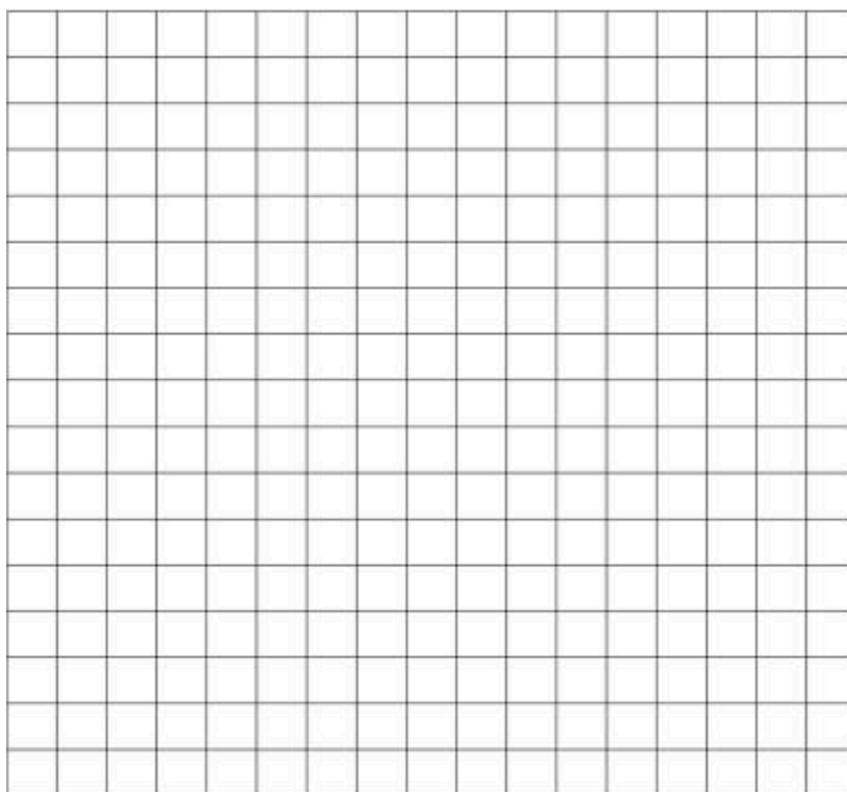
b. Evaluate this claim. In your response, describe the role of the CRISPR sequence in bacteria. 5 marks

Exercise scientists were interested in creatine supplementation in athletes. They conducted a study and produced the results below.

Creatine Intake (g/kg/day)	100m Sprint Time (seconds)
0.00	11.5
0.03	11.2
0.05	11.0
0.07	10.8
0.10	10.7
0.12	10.6

d. Graph the data provided in the table, above.

4 marks



The pH level in skeletal muscle can decrease to below 6.8 during high intensity exercise.

e. Using the information provided, above, explain how this may affect an athlete undertaking the 100m sprint.

3 marks

Question 6 (7 marks)

In a follow up experiment, a biopsy was performed and a culture of muscle cells were exposed to different oxygen levels. The raw data from this experiment are shown below.

Condition	Glucose uptake (mg/min)	ATP Production (mmol/min)	Lactate Production (mg/min)
100 mmol/L of Oxygen (A)	10	36	0
10 mmol/L of Oxygen (B)	12	10	5
0 mmol/L of Oxygen (C)	14	4	8

a. Based on the data in the table, state which metabolic pathways are likely dominant under conditions A and C. Justify your response. 4 marks

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b. Describe why the same muscle culture exposed to the conditions in Treatment B would exhibit both oxygen uptake and lactate production. 2 marks

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c. Identify **one** variable that would need to be controlled in this experiment. 1 mark

End of examination questions

ScienceLab Unit 3 Trial Exam 1 (2025)

Specific information

This report provides sample answers or an indication of what answers VCAA have accepted in the past.

Section A

Question	Correct answer	Comments
1	C	
2	D	The answer is D as both eukaryotic and prokaryotic translation do not contain introns. As eukaryotes remove them during mRNA processing and prokaryotes do not contain introns.
3	C	
4	A	C is the function of rRNA
5	C	A is translation. B is incorrect as exons are coding regions and are not removed during transcription.
6	C	DNA is un ambiguous, degenerate and universal. D is incorrect as mRNA codons are made up of three nucleotides.
7	C	An antiterminator loop forms during regulation of tryptophan gene expression. The antiterminator loop itself does not code for synthesis of tryptophan, that is achieved by the 5 structural genes.
8	B	B is correct as the trp operon codes for 5 enzymes that are involved in the creation of tryptophan.
9	C	
10	D	C is incorrect as bacteriophage/viral DNA does contain PAM and that is what allows the Cas9 complex to identify it as foreign.
11	B	B is correct as random errors are slight fluctuations between results that do not vary by a consistent amount.
12	C	Validity as defined by VCAA in the 2022-2026 Biology Study Design as “a measurement that measures what it is supposed to be measuring.”
13	D	The variable that is being measured is the dependent variable. The variable that is actively being altered by the experimenter is the independent variable.
14	C	
15	B	
16	C	C is correct. C4 has adaptation to reduce the effect of photorespiration by having initial carbon fixation completed by PEP carboxylase. Their adaptations allow for a high concentration of carbon dioxide to be present near RuBisCO
17	B	
18	C	

19	C	The graph depicts more than 25 ATP molecules being synthesised. Therefore, it can not be glycolysis or the Krebs cycle. It is crucial that students are aware of net ATP numbers for each stage.
20	B	
21	B	
22	A	
23	B	
24	B	2022-2026 Study Design dot point: “the use of genetically modified and transgenic organisms in agriculture to increase crop productivity and to provide resistance to disease”.
25	C	
26	B	TALENS is more expensive than CRISPR technology under all circumstances. However, the dotted line on the graph depicts the cost difference. The largest cost difference is seen in Gene Silencing.
27	A	
28	B	The infographic depicts both profit and loss for farmers. The red areas are the largest losses. The darkest blue areas are the largest profits.
29	D	A and C are incorrect as lower oxygen concentrations and higher carbon dioxide concentrations allow for greater binding to RuBisCO.
30	C	The legend in the infographic states “insufficient sample”. This suggests limited/incomplete data sets. “Students should be able to identify contradictory, provisional and incomplete data including possible sources of bias.”

Section B

Question 1 (17 marks)

a. Is Bt corn a transgenic organism? Justify your response.

<ul style="list-style-type: none"> • Transgenic • Contains a gene from a different species, the <i>Bacillus thuringiensis</i> 	0 marks	1 mark	2 marks
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b. Outline the process scientists would use to produce *Ostrinia nubilalis* resistant corn.

<ul style="list-style-type: none"> • Lab made sgRNA with complementary spacer sequence to the target DNA sequence • Cas9 enzyme is obtained with an appropriate target PAM sequence • Cas9 and gRNA are added together in a mixture and bind together to create the CRISPR-Cas9 complex • This is then injected into a specific cell, such as a zygote • The Cas9 finds the target PAM sequence and checks whether the gRNA aligns with the DNA • If complementary, Cas9 cuts the selected sequence of DNA • The cut DNA has a blunt end cut that the cell will attempt to repair. This is where we can add to the gene from <i>Bacillus thuringiensis</i> (Bt) is added. Allow plant to grow <p>OR</p> <ul style="list-style-type: none"> • Cut target gene and plasmid (with identifying gene/s, e.g. antibiotic resistance) with the same restriction enzyme to create complementary sticky ends. • Mix with DNA ligase to make recombinant plasmid. • Heat shock bacteria and mix with recombinant plasmid • Use selective agent (e.g. antibiotic such as ampicillin) to identify and select transformed bacteria • Allow transformed bacteria to replicate. They will treat the target gene as their own and make that protein. 	0 marks	1 mark	2 marks	3 marks	4 marks
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c. Describe the importance of tryptophan regulation in prokaryotes and outline how the concentration of free floating tryptophan influences this process.

<ul style="list-style-type: none"> • Trp high - trp binds to repressor, repressor to operator, stopping transcription of the structural genes • Trp low - no trp to bind to repressor, remains inactive and not bound to operator, allowing transcription of the structural genes <p>AND importance:</p> <ul style="list-style-type: none"> • Save resources / prevents wasting energy 	0 marks	1 mark	2 marks	3 marks
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d. Identify if corn husk is a primary or secondary generation of biofuel. Outline a method farmers could use to turn this waste into a form of additional income or energy for their farm.

<ul style="list-style-type: none"> • Second generation biofuel AND <ul style="list-style-type: none"> • Pre-treatment: Surface area of biomass increased by grinding of the plant matter • Enzymatic action: Hydrolysis enzymes added to break the bonds between monomers • Fermentation: Oxygen removed to allow for this to occur, yeast added • Ethanol produced undergoes distillation (water is removed), and added to petrol, converting it into biofuel 	0 marks	1 mark	2 marks	3 marks	4 marks	5 marks
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e. Considering adaptations of some plant types to maximise photosynthetic efficiency, explain why crops like wheat are better suited to Tasmania than Queensland.

<ul style="list-style-type: none"> • Wheat more likely to be a C3 plant / don't have adaptations to combat photorespiration • Tasmania's cooler temperatures are closer to the optimal ranges for wheat for photosynthesis to occur, with minimal photorespiration. Faster crop growth. • Queensland's more humid, warm conditions result in more photorespiration. Decreased crop growth. 	0 marks	1 mark	2 marks	3 marks
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Question 2 (5 marks)

a. Outline what would occur to a bacteria that did not take up the pBR322 plasmid.

<ul style="list-style-type: none"> • Bacteria that have not taken up the plasmid (not-transformed) will die on exposure to plates with either antibiotic 	0 marks	1 mark
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b. Insertion of the Rennin gene disrupts the gene coding for tetracycline resistance. Explain how transformed bacteria would be identified using the two antibiotic resistance genes found in the pBR322 plasmid.

<p>2 marks</p> <ul style="list-style-type: none"> • Transformed bacteria that have the recombinant plasmid will <ul style="list-style-type: none"> ○ survive on a plate with ampicillin, ○ but die on a plate with tetracycline <p>2 marks</p> <ul style="list-style-type: none"> • Transformed bacteria that do not have the recombinant plasmid <ul style="list-style-type: none"> ○ will survive on a plate that has ampicillin, ○ and will survive on a plate that has tetracycline, or both 	0 marks	1 mark	2 marks	3 marks	4 marks
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Question 3 (7 marks)

a. Identify which species has the highest water use efficiency and explain how its photosynthetic adaptation contributes to this ability.

<ul style="list-style-type: none"> • <i>Portulaca australis</i> • Stomata closed during the day AND <ul style="list-style-type: none"> • Helps prevent water loss during the hottest part of the day 	0 marks	1 mark	2 marks	3 marks
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b. Compare the role of RuBisCO in these three plant types.

<ul style="list-style-type: none"> • Rubisco is responsible for carbon fixation in all three plant types 	0 marks	1 mark
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c. Define reproducibility and outline how the reproducibility could be improved.

<ul style="list-style-type: none"> • Somebody else (a different observer) conducts your experimental design (but using different equipment, different place etc.), and gets the same/very similar results, it is said to be reproducible. • They could get scientists from other places around the world / country to see if they also gathered similar findings, using the same experimental design 	0 marks	1 mark	2 marks
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d. Identify what scientific methodology was used to collect this data.

<ul style="list-style-type: none"> • Fieldwork 	0 marks	1 mark
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Question 4 (7 marks)

a. With reference to the information above, justify which of the Cas proteins has the broadest function.

<ul style="list-style-type: none"> • Cas9 • Is able to performing, expression, interference and adaptation, 3 functions, whereas all the others can only perform one or two functions 	0 marks	1 mark	2 marks
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b. Evaluate this claim. In your response, describe the role of the CRISPR sequence in bacteria.

<p>Any three of:</p> <ul style="list-style-type: none"> • To provide memory of previous viral exposures • To be transcribed into gRNA • gRNA (produced from transcription) guides Cas9 to find foreign, complementary viral DNA / RNA • Heritable immunity <p>Evaluate, and two of:</p> <p>“Agree” mark:</p> <ul style="list-style-type: none"> • It can be considered a primitive adaptive immune system as it does hold memory stored as spaces, in the CRISPR region • It provides sequence-specific, adaptive immunity to prokaryotes, searching for the complementary sequence <p>“Disagree” mark</p> <ul style="list-style-type: none"> • Over-Simplification: Calling it an “immune system” may oversimplify its molecular mechanism • Natural Defense, but Limited Scope: CRISPR protects only against nucleic acid invaders like phages and plasmids, not other threats like toxins or environmental stress. 	0 marks	1 mark	2 marks	3 marks	4 marks	5 marks
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Question 5 (17 marks)

a. Describe what would occur in the matrix of a mitochondria that would lead to the production of creatine kinase.

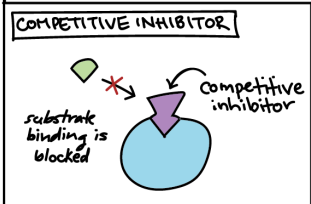
<ul style="list-style-type: none"> • RNA polymerase binds to promoter region of the template strand • RNA polymerase begins creating a mRNA strand using free complementary nucleotides, replacing thymine with uracil • RNA polymerase reaches a stop sequence and the mRNA is released • mRNA initiates translation at the ribosome, once the start codon is read • tRNA with the anticodon complementary to the codon being translated transports the specific amino acid • A stop codon is reached and the polypeptide chain is released 	0 marks	1 mark	2 marks	3 marks	4 marks	5 marks	6 marks
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Feedback: Important to note that this question does not allow for students to describe any of the processes associated with mRNA processing as mtDNA does not contain introns due to their bacterial origins.

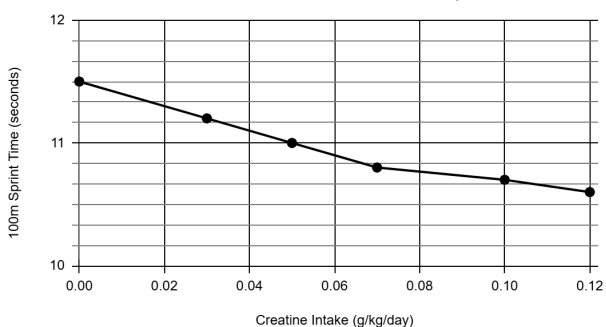
b. Identify the monomer of creatine kinase.

<ul style="list-style-type: none"> • Amino acid 	0 marks	1 mark
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c. Draw and label the action of 2,4-dinitro-1-fluorobenzene on creatine kinase.

 <p>1 mark for each of the following:</p> <ul style="list-style-type: none"> • Competitive inhibitor binding to active site • Substrate also has complementary shape, but is prevented from binding • Correct labels for inhibitor, substrate and enzyme 	0 marks	1 mark	2 marks	3 marks
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d. Graph the data provided in the table, above.

<p>The effect of Creatine Intake on 100m Sprint Time</p>  <ul style="list-style-type: none"> • Title • Even intervals • Appropriate Plotting • Axis labels 	0 marks	1 mark	2 marks	3 marks	4 marks
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e. Using the information provided, above, explain how this may affect an athlete undertaking the 100m sprint.

Any two of: <ul style="list-style-type: none"> • Lower pH may be out of optimal range for creatine kinase • Changes the structure of the active site / bonds loosen • Creatine kinase can not convert creatine to phosphocreatine as effectively AND <ul style="list-style-type: none"> • Won't be able to run as fast (slower splits towards the end of race) 	0 marks	1 mark	2 marks	3 marks
Comments <ul style="list-style-type: none"> • Not denature • Explain command term, must include a link to how it impacts the 100m sprint (relationship between two things) 				

Question 6 (7 marks)

a. Based on the data in the table, state which metabolic pathways are likely dominant under conditions A and C. Justify your response.

<ul style="list-style-type: none"> • A - Krebs Cycle and ETC • Justify - with high oxygen uptake (20ml/min), glucose can be completely broken down via aerobic respiration, as represented by 36 ATP being produced • C - Anaerobic Fermentation • Justify - in no oxygen conditions (0ml/min), the cell can only produce energy via glycolysis (4 ATPmmol/min) then cycles NAD around during fermentation to produce lactate (8mg/min) 	0 marks	1 mark	2 marks	3 marks	4 marks
Comments <ul style="list-style-type: none"> • Must include evidence from the above table in justification 					

b. Describe why the same muscle culture exposed to the conditions in Treatment B would exhibit both oxygen uptake and lactate production.

<ul style="list-style-type: none"> • Oxygen available for pyruvate to enter mitochondria for start of experiment • Oxygen supplies diminish, therefore, must revert to anaerobic fermentation 	0 marks	1 mark	2 marks
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c. Identify **one** variable that would need to be controlled in this experiment.

Any one of: <ul style="list-style-type: none"> • Type / age / sample of human muscle cells • Number of human muscle cells • Duration of experiment (mins) Any other reasonable response	0 marks	1 mark
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